Activity: Start and Exercise the Ground System

In this activity, you will build the Ground System project for cFS, start the Ground System, receive telemetry from cFS, and send commands to cFS.

# Materials and Requirements

* X Server and SSH client or keyboard and monitor attached directly to the BeagleBone AI.

# Build the Ground System

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| 1 | Install python prerequisites. Use apt-get to install python-qt4, python-qt4-dev, python-zmq. | debian@beaglebone:~/cFS$ sudo apt-get update  [sudo] password for debian:  Get:1 http://repos.rcn-ee.com/debian stretch InRelease [3,064 B]  Ign:2 http://deb.debian.org/debian stretch InRelease  Get:3 http://deb.debian.org/debian stretch-updates InRelease [91.0 kB]  Get:4 http://deb.debian.org/debian-security stretch/updates InRelease [94.3 kB]  Hit:5 http://deb.debian.org/debian stretch Release  Get:6 http://repos.rcn-ee.com/debian stretch/main armhf Packages [1,180 kB]  Get:7 http://deb.debian.org/debian-security stretch/updates/main armhf Packages [495 kB]  Fetched 1,863 kB in 29s (63.4 kB/s)  Reading package lists... Done  debian@beaglebone:~/cFS$ sudo apt-get install python3-pyqt4 python3-zmq  Reading package lists... Done  Building dependency tree  Reading state information... Done  The following additional packages will be installed:  libaudio2 libmng1 libpgm-5.2-0 libqt4-dbus libqt4-declarative libqt4-designer libqt4-help libqt4-network libqt4-script  libqt4-scripttools libqt4-sql libqt4-sql-mysql libqt4-svg libqt4-test libqt4-xml libqt4-xmlpatterns libqtassistantclient4  libqtcore4 libqtdbus4 libqtgui4 libsodium18 libzmq5 python3-sip qdbus qt-at-spi qtchooser qtcore4-l10n  Suggested packages:  nas libqt4-declarative-folderlistmodel libqt4-declarative-gestures libqt4-declarative-particles libqt4-declarative-shaders  qt4-qmlviewer libqt4-dev qt4-qtconfig python3-pyqt4-dbg  The following NEW packages will be installed:  libaudio2 libmng1 libpgm-5.2-0 libqt4-dbus libqt4-declarative libqt4-designer libqt4-help libqt4-network libqt4-script  libqt4-scripttools libqt4-sql libqt4-sql-mysql libqt4-svg libqt4-test libqt4-xml libqt4-xmlpatterns libqtassistantclient4  libqtcore4 libqtdbus4 libqtgui4 libsodium18 libzmq5 python3-pyqt4 python3-sip python3-zmq qdbus qt-at-spi qtchooser qtcore4-l10n  0 upgraded, 29 newly installed, 0 to remove and 1 not upgraded.  Need to get 16.2 MB of archives.  After this operation, 46.9 MB of additional disk space will be used.  Do you want to continue? [Y/n] y  Get:1 http://deb.debian.org/debian stretch/main armhf libaudio2 armhf 1.9.4-5+b1 [73.7 kB]  Get:2 http://deb.debian.org/debian stretch/main armhf libmng1 armhf 1.0.10+dfsg-3.1+b5 [159 kB]  Get:3 http://deb.debian.org/debian stretch/main armhf libpgm-5.2-0 armhf 5.2.122~dfsg-2 [155 kB]  <snip>  Setting up libqtassistantclient4:armhf (4.6.3-7+b1) ...  Setting up libqt4-declarative:armhf (4:4.8.7+dfsg-11) ...  Setting up python3-pyqt4 (4.11.4+dfsg-2+b1) ...  Processing triggers for libc-bin (2.24-11+deb9u4) ... |
| 5 | Build the Ground System. | debian@beaglebone:~/cFS$ cd tools/cFS-GroundSystem/Subsystems/cmdUtil/  debian@beaglebone:~/cFS/tools/cFS-GroundSystem/Subsystems/cmdUtil$ make  gcc -o cmdUtil SendUdp.c cmdUtil.c |

# Start the Ground System

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| 1 | Start the Ground System. Because the Ground System launches a GUI, you will need to start the Ground System from a terminal that has access to an X Server. If using a Mac or Linux machine to access the BeagleBone AI, you can use X11 forwarding in SSH by starting SSH with the -X option. If using a Windows machine, you will need to install X Server software such as MobaXterm, Cygwin, or Xming. | debian@beaglebone:~/cFS/tools/cFS-GroundSystem/Subsystems/cmdUtil$ cd ../..  debian@beaglebone:~/cFS/tools/cFS-GroundSystem$ python3 GroundSystem.py  Attempting to wait for UDP messages |
| 2 | Start cFS in a separate terminal. | debian@beaglebone:~/cFS$ cd build/exe/cpu1/  debian@beaglebone:~/cFS/build/exe/cpu1$ ./core-cpu1  <snip>  1980-012-14:03:20.35086 ES Startup: CFE\_ES\_Main entering OPERATIONAL state  EVS Port1 42/1/CFE\_TIME 21: Stop FLYWHEEL |

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# Receive Telemetry

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| 1 | Launch the command system.. |  |
| 2 | Bring up the page to enable telemetry. |  |
| 3 | Send the command to enable telemetry output. First, enter the IP address of 127.0.0.1. Second, click the Send button. Finally, click the Close button.  Observe the output of the Ground System to the terminal.  Observe the output from cFS to the terminal. | ---------------------------------------  Host: 127.0.0.1  Port: 1234  Pkt ID: 0x1880  sending data to '127.0.0.1' (IP : 127.0.0.1); port 1234  Data to send:  0x18 0x80 0xC0 0x00 0x00 0x11 0x00 0x06  0x31 0x32 0x37 0x2E 0x30 0x2E 0x30 0x2E  0x31 0x00 0x00 0x00 0x00 0x00 0x00 0x00  Detected Spacecraft1 at 127.0.0.1  ---------------------------------------  EVS Port1 42/1/TO\_LAB\_APP 3: TO telemetry output enabled for IP 127.0.0.1 |
| 4 | Start the telemetry subsystem. |  |
| 5 | Observe the “Packets Received” count and the “Packet Count” values increase.  Click the “Display Page” buttons to the right of populated subsystems to see more detail. |  |